REMARKS

This is intended as a full and complete response to the Office Action dated November 6, 2002, having a shortened statutory period for response set to expire on February 6, 2003. Please reconsider the claims pending in the application for reasons discussed below.

I. REJECTION OF CLAIMS UNDER 35 U.S.C. §112, second paragraph

The Examiner rejected claims 1-13 as being indefinite for failing to particularly point out and distinctly claim the subject matter that the Applicants regard as the invention. Specifically, the Examiner asserted in paragraph 17 of the Office Action that the scope of the preamble in claims 1, 6, and 12 fails to match the body of the claims since no means for conducting an etching step is recited in the body of the claims as it is recited in the preamble of the claims.

The Examiner's attention is directed to the fact that claim 1, as amended, recites, in step (c), "etching one or more layers from a substrate comprising silicon". Similarly, independent claim 6, as amended, recites, in step (c), "etching one or more layers from the substrate, wherein the one or more layers comprise silicon". Furthermore, independent claim 12, as amended, recites, in step (b), "etching of the substrate".

Thus, the Applicants submit that claims 1, 6 and 12, as amended, fully satisfy the requirements of 35 U.S.C. § 112, second paragraph.

Furthermore, claims 2-4, 7-9, 11, and 13 depend, either directly or indirectly, from claims 1, 6, and 12, respectively, and recite additional features therefor. As such, dependent claims 2-4, 7-9, 11, and 13 are also not indefinite.

Therefore, the Applicants submit that the rejection of claims 1-4, 6-9 and 11-13 have been obviated and respectfully requests the Examiner to withdraw the rejection.

The Applicants have canceled claims 5 and 10, therefore the rejection of claims 5 and 10 is moot.

II. REJECTION OF CLAIMS UNDER 35 U.S.C. §102(e)

The Examiner rejected claims 1, 4-5, 18, 21, and 25-26 as being anticipated by the Qian et. al patent (United States patent 6,136,211, issued Oct. 24, 2000). The rejection is respectfully traversed.

More specifically, the Examiner alleged in paragraph 19 of the Office Action that Qian et. al disclosed a process for simultaneously etching a Si based compound and for cleaning an etch residue using a plasma comprising, in various combinations, etchant gases such as Cl_2, N_2, O_2, HBr, or He-O_2 and cleaning gases such as NF_3, CF_4, or SF_6. The Examiner concluded that applicant's invention is anticipated by Qian et. al. The Applicants respectfully disagree.

Qian et. al teaches a method of etching a substrate providing a process gas that comprises:

Cl_2, N_2, and CF_4 at volumetric flow ratio CF_4:(Cl_2 + N_2) from about 1:20 to 1:1; or

Cl_2, N_2, and SF_6 at volumetric flow ratio SF_6:(Cl_2 + N_2) from about 1:20 to 1:1; or

Cl_2, N_2, and NF_3 at volumetric flow ratio NF_3:(Cl_2 + N_2) from about 1:20 to 1:1 (col. 4, lines 11-29; col. 9, lines 42-60).

The Examiner's attention is directed to the fact that Qian et. al do not teach, show, or suggest a method of etching substrates using at least a first etchant that is selected to minimize deposition of a material on the internal surfaces and, when disassociated in a plasma, recombines with the material on the internal surfaces (i.e., internal surfaces of the etch chamber), as recited in claim 1, as amended.

Furthermore, Qian et. al do not teach, show, or suggest during substrate etching depositing a film on the internal surfaces of the chamber where a first recombination rate of one or more plasma constituents with the internal surfaces is substantially equal to a second recombination rate of the one or more plasma constituents with the film, as recited in independent claim 18.

Yet furthermore, Qian et. al do not teach, show, or suggest a method of etching a substrate using the chemical mixture comprising a bromine-containing fluid and at least one of fluorine-containing fluid and chlorine-containing fluid, as recited in independent claim 21, as amended.

"Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim." Lindemann

Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added).

The Applicants contend that independent claims 1, 18, and 21, as amended, are patentable over Qian et. al and, as such, fully satisfy the requirements of 35 U.S.C. §102(e) and are patentable thereunder.

Furthermore, claims 4 and 25, 26 depend, either directly or indirectly, from claims 1 and 21, respectively, and recite additional features therefor. Since Qian et. al would not produce the Applicant's invention as recited in claims 1 and 21, as amended, dependent claims 4 and 25-26 are also not obvious and are allowable.

Therefore, the Applicants submit that the rejection of claims 1, 4, 18, 21, and 25-26 has been obviated and respectfully requests the Examiner to withdraw the rejection.

The Applicants have canceled claim 5 therefore the rejection of claim 5 is moot.

III. REJECTION OF CLAIMS UNDER 35 U.S.C. §103(a)

The Examiner rejected claims 2-3, 6-11, and 22-24 as being unpatentable over the Qian et. al patent (United States patent 6,136,211, issued Oct. 24, 2000). The rejection is respectfully traversed.

More specifically, the Examiner conceded in paragraph 22 of the Office Action that Qian et. al failed to disclose specific etching process parameters. The Examiner alleged that these parameters are well known variables in the plasma etching art. The Examiner concluded that that it would have been obvious to one of ordinary skills in the art to select particular values for process parameters. The Applicants respectfully disagree.

As discussed above in Section II, Qian et. al teaches a method of etching a substrate in an etching chamber providing process gas comprising: Cl_2, N_2, and CF_4; or Cl_2, N_2, and SF_6; or Cl_2, N_2, and NF_3.

Qian et. al do not teach, show, or suggest a method of etching substrates using at least a first etchant that is selected to minimize deposition of a material on the internal surfaces and, when disassociated in a plasma, recombines with the material on the internal surfaces, as recited in claim 1, as amended. As such, Qian et. al do not render obvious such method or process variables of the Applicant's invention.

Therefore, the Applicants contend that claim 1, as amended, is patentable over Qian et. al and, as such, fully satisfies the requirements of 35 U.S.C. §103(a) and is patentable thereunder.

Furthermore, claims 2-3 depend, either directly or indirectly, from claim 1 and recite additional features therefor. Since Qian et. al would not produce the Applicant's invention as recited in claim 1, as amended, dependent claims 2-3 are also not obvious and are allowable.

Qian et. al do not teach, show, or suggest a method of etching a substrate where a disassociated first etchant deposits material on the internal surfaces of the chamber at a first rate and a disassociated second etchant deposits material at a second rate that is less than the first rate, as recited in independent claim 6, as amended.

Therefore, the Applicants contend that independent claim 6, as amended, is patentable over Qian et. al and, as such, fully satisfies the requirements of 35 U.S.C. §103(a) and is patentable thereunder.

Furthermore, claims 7-9 and 11 depend, either directly or indirectly, from claim 6 and recite additional features therefor. Since Qian et. al would not produce the Applicant's invention as recited in independent claim 6, as amended, dependent claims 7-9 and 11 are also not obvious and are allowable.

As discussed above in Section II, Qian et. al do not teach, show, or suggest a method of etching a substrate using the chemical mixture comprising a bromine-containing fluid and at least one of fluorine-containing fluid and chlorine-containing fluid, as recited independent claim 21, as amended.

Furthermore, Qian et. al do not teach, show, or suggest a specific volumetric flow ratio between a bromine-containing fluid and at least one of fluorine-containing fluid and chlorine-containing fluid, as recited in dependent claims 22-23, as amended. As such, Qian et. al do not render obvious the process variables of the Applicant's invention.

Therefore, the Applicants contend that independent claim 21 is patentable over Qian et. al and, as such, fully satisfies the requirements of 35 U.S.C. §103(a) and is patentable thereunder.

Furthermore, claims 22-23 depend, either directly or indirectly, from claim 21 and recite additional features therefor. Since Qian et. al would not produce the Applicant's

invention as recited in claim 21, as amended, dependent claims 22-23 are also not obvious and are allowable.

Therefore, the Applicants submit that the rejection of claims 2-3, 6-9, 11, and 22-23 has been obviated and respectfully requests the Examiner to withdraw the rejection.

The Applicants have canceled claims 10 and 24, therefore the rejection of claims 10 and 24 is moot.

IV. ALLOWABLE SUBJECT MATTER

Applicants acknowledge and express appreciation for indication in Paragraph 23 of the Office Action that claims 19-20 and 33-34 are allowed. The claims 33-34 are amended for administrative reasons.

V. CONCLUSION

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the method or apparatus of the present invention. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action. Accordingly, allowance of the claims is respectfully requested.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please cancel claims 5, 10, 24, and 30-32.

Please rewrite claims as follows:

1. (Twice amended) A method of etching substrates in a chamber having internal surfaces, comprising:

(a) introducing at least a first etchant into the chamber wherein the first etchant is selected to minimize deposition of a material on the internal surfaces; [and]

(b) striking a plasma in the chamber to cause disassociation of the first etchant wherein the disassociated first etchant [comprises a first recombination rate] recombines with the material on the internal surfaces; and [substantially different than a second recombination rate with the internal surfaces.]

(c) etching one or more layers from a substrate comprising silicon.

4. (Amended) The method of claim 1, wherein the first etchant comprises [Chlorine, Hydrogen] chlorine, hydrogen chloride, and combinations thereof.

6. (Twice amended) A method of etching a substrate in a chamber having internal surfaces, comprising:

(a) flowing at least a first etchant and a second etchant into the chamber, wherein a volumetric flow of the first etchant is greater than a volumetric flow of the second etchant; and

(b) striking a plasma in the chamber to cause disassociation of the first etchant and the second etchant, wherein the disassociated first etchant deposits material on the internal surfaces at a first rate and the disassociated second etchant deposits material on the internal surfaces at a second rate less than the first [rate.] rate; and

(c) etching one or more layers from the substrate, wherein the one or more layers comprise silicon.

7. (Amended) The method of claim 6, wherein the first etchant comprises [Chlorine,] chlorine, hydrogen chloride, and combinations thereof.

8. (Amended) The method of claim 6, wherein the second etchant comprises bromine, [Hydrogen Bromide,] hydrogen bromide, and combinations thereof.

12. (Twice amended) A method of etching a substrate in a chamber having internal surfaces, comprising:

(a) flowing at least a first etchant and a second etchant into the chamber, wherein a volumetric flow of the first etchant is greater than a volumetric flow of the second etchant;

(b) striking a plasma in the chamber to cause disassociation of the first etchant and the second etchant and etching of the substrate, wherein the disassociated first etchant deposits material on the internal surfaces at a first rate and the disassociated second etchant deposits material on the internal surfaces at a second rate less than the first rate; and

(c) flowing oxygen into the chamber.

21. (Twice amended) A method of etching a substrate, comprising:

(a) inserting a substrate into a chamber;

(b) flowing [a chemical mixture into a chamber, the chemical mixture comprising:

(i) one or more of a bromine-containing fluid and a chlorine-containing fluid; and

(ii) a fluorine-containing fluid;

wherein a volumetric flow of the one or more of the bromine-containing fluid and the chlorine-containing fluid is at least 50% of the chemical mixture;] into the chamber a chemical mixture comprising a bromine-containing fluid and at least one of fluorine-containing fluid and chlorine-containing fluid;

(c) striking a plasma; and

(d) etching the substrate.

22. (Amended) The method of claim 21, wherein the fluorine-containing fluid comprises [one or more of SF_6, NF_3 and any combination thereof and wherein a volumetric flow of the fluorine-containing fluid is less than about 20% of the chemical mixture.] at least one of SF_6 and NF_3 each provided at a volumetric flow that is less than about 20% of the volumetric flow of the chemical mixture.

23. (Amended) The method of claim 21, wherein fluorine-containing fluid comprises CF_4 and O_2 [and wherein a volumetric flow of the fluorine-containing fluid is less than about 50% and a volumetric flow ratio of CF_4 to O_2 is about 4:1.] that are provided at a volumetric flow ratio of CF_4:O_2 of about 4:1 and at a volumetric flow that is less than about 50% of the volumetric flow of the chemical mixture.

33. (Amended) The method of claim 19, wherein the one or more plasma constituents comprises [Chlorine, Hydrogen Chloride,] chlorine, hydrogen chloride, and combinations thereof.

34. (Amended) The method of claim 19, wherein the one or more plasma constituents comprises [Bromine, Hydrogen Bromide,] bromine, hydrogen bromide, and combinations thereof.